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ABSTRACT

This report presents the proceedings of a one-day conference held at the University of Bath in the United Kingdom in December, 1977. The conference debated a variety of educational issues, technology, and changes in society. In doing so the participants tried to discuss how best to respond to specific needs of society, and how to deploy limited resources to achieve the most gains. The specific topics included a profile of the post-industrial society; change in British industry; and employment and technological change. The report includes ideas and strategies for developments in the form of recommendations that summarize the points made by various speakers. The report also lists the names and titles of the participants in the conference. (GA)

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Strategies for Change in a Technological Society

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Conference Report

Bath University
20 December 1977

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STEC — University of Bath Science and Technology Education Centre

in association with

SCSST — The Standing Conference on Schools' Science and Technology

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Editor

Dr. Ray Page, formerly Director of the
Science and Technology Education Centre,
School of Education, University of Bath

INTRODUCTION AND WELCOME

Chairman: Dr. W. H. Barlington, Managing Director of Stothert and Pitt Ltd.

Speaker: Professor P. J. Matthews, Vice-Chancellor of Bath University

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After a brief reference to appearing together at a recent handing-over ceremony, the Chairman introduced the Vice-Chancellor to the Conference. The Vice-Chancellor then welcomed members with the following address:

"Mr. Chairman, I do not want to take up a lot of your time as you have got a very full day in front of you, but as Vice-Chancellor I would just like to say how extremely happy I am to welcome you here and how pleased I am that this Conference on "Strategies for Change in a Technological Society" is taking place at the University of Bath. The Chairman has already mentioned briefly that the last time he and I appeared together in public he was presenting to the University, and I was receiving for it, a magnificent engine which Stothert and Pitt was handing over to the University. The photographs appeared with the two of us in front of this machine in the Times Higher Educational Supplement, and in the caption he was described as the Vice-Chancellor and I as the Director of Stothert and Pitt. Evidently he fits the popular image of what a Vice-Chancellor ought to look like, and I was more like a tycoon. I think we can both take this as a compliment, because today's Conference is after all considering the relationship between the technological society and the educational system. I must say I am very impressed by the questions the Conference is tackling:

Why does production excite us less than our industrial rivals?

Why are so few of our young people enthusiastic about the application of knowledge, inventiveness and artistry? - I think that question begs a lot of questions if I may say so.

What kind of society is technology making possible? Are we free to choose? How can technology be made more accountable to society?

What are the future prospects for employment with what kind of people and skills required?

These are very profound and difficult questions to tackle within one day. We do live in a technological society whether we like it or not. Clearly a very vital question is that there is a matching between the needs, the aspirations and the abilities of the young people going into that society and of society itself, and, if the matching up is to be satisfactory, there are obviously only two ways to change it. Both of them are very difficult, but one is even harder than the other. The first is to change the educational system which affects most people in society, and the other is to change society itself. I would be interested to find out where you feel the solution lies at the end of the day. Maybe a change in society is perhaps not so difficult as it might look, because I suppose there are considerations pushing in the same sort of direction from a different place. I am speaking, of course, in terms of conservation, natural resources and the use of degradable materials and things of that sort. However, the last thing I want to do is to create your discussion for you."

Dr. Darlington then dealt briefly with some administrative matters and introduced the morning's speakers in turn. After each lecture a short time was devoted to a brief discussion. Any important points raised in these discussions and the Forum at the end of the conference have been edited into the section of this report headed OPEN FORUM.

SOME QUESTIONS FOR DISCUSSION

Why does production excite us less than our industrial rivals?

Why are so few of our young people enthusiastic about the application of knowledge, inventiveness and artistry?

What kind of society is technology making possible? Are we free to choose? How can technology be made more accountable to society?

What are the future prospects for employment with what kind of people and skills required?

In short, how can we achieve direction and purpose and whom shall we involve in conceiving the necessary regeneration?

The purpose of the conference is not only to debate these issues but more importantly to consider how best to respond to specific needs and to deploy limited resources most effectively in the region.

A PROFILE OF THE POST-INDUSTRIAL SOCIETY

Chairman
Dr. W. H. Darlington

Speaker
Professor Tom Stonier
School of Science and Society
University of Bradford

Over the past twenty years there has occurred a cultural discontinuity as significant as the Industrial Revolution. Because we are so close to this discontinuity it is difficult to perceive. We must therefore first define both the discontinuity and the basis of that discontinuity.

At the heart of the present transition lies the Electronic Revolution. This revolution differs from the Industrial Revolution as follows. The Industrial Revolution was concerned with the invention of devices which extended the human musculature. The machinery of the Industrial Revolution involved mechanical operations such as lifting, transporting, digging, weaving, spinning, milling, etc - all manual operations. In contrast, the Electronic Revolution involves devices which extend the human nervous system: the telephone and radio an extension of the ear, film initially an extension of the eye, then coupled to sound, television an extension of the eye and ear, and now, of course, the computer an extension of the brain. The invention of mechanical devices which pre-dated the Industrial Revolution by several centuries laid the groundwork for a new mode of production which was the basis of the industrial economy. Similarly, the Electronic Revolution laid the groundwork for a new era which may be called the "Communicative Era", in which the electronic devices permit the introduction of new modes of production and create an entirely new set of economic factors.

The Post-Industrial Economy

There are a series of basic characteristics of the post-industrial economy which include:

(a) it is primarily a service economy rather than a manufacturing one,

(b) it is a credit-based economy rather than one involving cash transactions,

(c) it is becoming primarily trans-national rather than national,

(d) changes are taking place at an exponential rate rather than linearly.

Economic Sectors

Economies progress in identifiable stages from primary through secondary to tertiary and beyond. The categories which relate to the primary sector of the economy include agriculture, mining, forestry and fishing, that is, the production of foodstuffs and raw materials.

The secondary sector of the economy involves the manufacture of goods.

The tertiary sector involves services such as transportation, communication, public utilities. The quarternary sector involves activites such as banking, finance and commerce in general. The quinary sector involves increasingly abstract activities, including education.

The Post-Industrial Economy

The shift from primary to secondary economic activity took place during the industrial era. Today, in Britain the post-industrial economy is seeing a shift to tertiary economic activities and beyond - both in terms of the labour force and in terms of profits. The principal economic activities in all technologically advanced countries now take place in the post-tertiary phase of the economy.

If one looks at the shifting employment patterns in the United States since the beginning of this century, it becomes apparent that farm labour has been declining in absolute terms since about World War I. Industrial labour is beginning to decline today, while the "white collar" work force has increased in size and proportion. Among white collar workers there has been a shift from clerical to managerial to professional/technical.

The figures for Britain are similar. They reflect in part, a mechanism which has helped to produce the structural unemployment characteristic of British industry - a pattern which is universal for the Western World: industries which are labour-intensive tend to move to the Third World where labour is cheaper. Alternatively, such industries become mechanised and automated, in which case they need by far fewer employees. Within the secondary sector of the economy, the really profitable manufacturing industries involve enterprises such as pharmaceuticals, chemicals, electronics, computers. These are characterised by three features. First, they are relatively labour non-intensive because the plants are all built in accordance with the latest technological production techniques. Secondly, they are all capital-intensive and usually involve multi-national sources of capital. Thirdly, they are all knowledge-based. Thus, in the secondary (manufacturing) sector of the economy, knowledge (a product of the quinary sector) becomes an increasingly important input.

The shift into the post-tertiary sector, particularly in the quarternary and quinary sectors of the economy, reflects the importance of knowledge as an economic commodity. Many firms exist by selling knowledge: among others, solicitors, accountants, architects and consultant engineers. The traditional economic factors of production, land, labour, raw materials and capital are becoming increasingly displaced by knowledge. Land, for example, can be utilised much more efficiently through knowledge: a modern chicken farm/factory is a prime example of increasing productivity enormously with much less land as a result of new technology. The displacement of labour by mechanisation and automation has already been discussed. Materials can be increasingly substituted by new man-made ones, and capital is being replaced increasingly by devising new credit systems, a process which began several centuries ago with the Dutch bankers. The common myth today is that manufactured products represent the only real source of wealth. Those who hold this view should be called "latter-day physiocrats". The physiocrats of the eighteenth century held that the only real wealth was produced by land, not by manufacture. We now know that they were wrong. Today, the real wealth producer in post-industrial societies is neither land nor manufacture, but knowledge.

It is significant that when one considers factors such as land, labour, raw materials, capital and knowledge, industry is largely responsible for the purchase of land, labour, raw materials, and capital, but not for knowledge. The knowledge was produced almost entirely at social expense. The knowledge industry, and its base, the education system, are largely supported by public funds and are probably the most important single indicator of economic potential

in post-industrial countries. That is, the real wealth of the nation is no longer measured by its fertile land, the coal and oil, its forests and seas, its mineral wealth, etc. - these all help, but the most important single resource is the skills and knowledge which its people possess.

Just as we have the concept of machine operatives, we now need to define the concept of information operatives, that is, people who make a living by creating, transmitting, organising, storing and retrieving information. These are by far the largest and most important form of labour today. They include, among others, scientists and statisticians, all educators, all working in the mass media, technical salesmen, all forms of managers, filing clerks, typists, accountants, etc. We should also add students: a few generations ago children worked in the pits, mills, and households, and were considered as part of the labour force. By adding that portion of the population which now makes a living receiving information, as information operatives, we see that such operatives comprise the vast bulk of the post-industrial labour force.

In so far as the basis of the knowledge industry is the education system, any country which cuts its expenditures on education is engaged in short-sighted economies which are bound to reduce its economic growth a decade or so later. To be more blunt: Britain is castrating its future by reducing its education expenditure. If it persists in doing this, its competitive position in the world will be reduced to a second-rank economy. Economists and industrialists must be made aware that Government expenditures on education must not be classed as consumption in national income analysis, but must be classed as investment, surely as important as building roads or airports or harbours. The latter comprise part of the physical infrastructure of a nation's economy. Similarly, the education system comprises an important part of the intellectual infrastructure necessary for running post-industrial societies.

Whither Education?

We should be training more sophisticated operatives - people who not only are trained for a specific skill, as an engineer or architect, but who also have a much broader sense of the modern world in which we live. All forms of production now involve an enormous imput of knowledge. For example, a typical farm in Minnesota, including land and equipment, is now worth about a million dollars, and represents a primary industry now being run by means of quarternary and quinary inputs - hybrid seeds, fertilizers, pesticides, cost analyses, etc. The Japanese now build more than half of the world's merchant ships. Is this because a greater depth of engineering knowledge is diffused throughout the shipyards - because most managers have engineering degrees? Here again a traditional industry in the secondary sector of the economy became highly productive and therefore competitive, by new inputs of knowledge.

In spite of the above examples, we should not confuse the need for improved technical education with the requirements for general education which leads to much more sophisticated and advanced knowledge systems and an understanding of the problems of society. For example, Britain could probably become energy independent and food independent - perhaps even export both energy and food, if it harnessed wave power and coastal fish farming. The question as to why this goal is not considered seriously by national planners is not so much technical, but political, economic, social and psychological. Neither training in the classics, the arts, the humanities, nor specialised scientific or engineering disciplines are likely to create decision makers with the understanding and imagination to devise the research programmes to exploit the potential of these enormous resources.

We need to educate people to change careers in mid-stream, we have to combat technological illiteracy among the arts and humanities students, and we have to combat social and humanitarian illiteracy among the technocrats.

We must also get rid of the Protestant work ethic which evolved at the beginning of the mechanical era, and which helped to set the stage for the Industrial Revolution. We have to face the fact that there is going to be more unemployment, that people are going to be on the dole for long periods of time and that we mustn't destroy them psychologically. The dole must be raised to support people adequately physically, and then we must support them educationally, so that they will view this period of their life as a potential for growth, a kind of sabbatical, rather than being thrown on an economic rubbish heap. We must aim for an eighteen-hour work week, that is to say, to roughly halve the work week, as the work week has been halved already over the last hundred and fifty years, only this time we should do it in thirty years.

Associated with the reduced working time must come a new ethos in which we expect everyone to utilise his or her spare time in at least three ways:

(a) To grow intellectually, to take courses, to go for advanced degrees, to travel, to read, etc.

(b) To develop our talents. They may be playing a good game of chess, being a good batter at cricket, growing large tomatoes, weaving beautiful rugs ... There is something in all of us, and that something should be developed. There should be an enormous increase in human creativity.

(c) To help care for others. We must all recognise that we are our neighbour's keeper, and the definition of the neighbourhood must become global. This should manifest itself in a myriad of different ways, ranging from spending afternoons next door with an old lady who has no-one to look after her, to digging irrigation ditches half-way around the world. The ethos of caring for others must become an essential part of the new society of leisure.

Future Education Systems

In general, future systems will become less coercive. The school-leaving age ought to be reduced as soon as possible - as soon as the system is properly organised to allow people to leave at any stage, but also to return to any stage. It would be much better to lower the school-leaving age to 14 if the pupils have a definite job lined up. To let them go out, let them earn a living for a few years in some dull job and then come back into the education system when they realise that such jobs aren't such a wonderful thing either. If we structure the education system properly so that people will remain in the system right through university, it would almost automatically solve the unemployment problem: the number of 17 to 20-year-olds who are not in school or university exceed the number of unemployed. If we made the education system sufficiently attractive, and in fact used some of the unemployed to expand the system, we would have solved the unemployment problem. Such a scheme would not only solve the unemployment problem, it would vastly increase the productive potential of the country. It would in effect, be a sound economic investment.

Finally, I would like to see education move in three directions:

(a) As the work week reduces to 18 hours, so should the time spent formally in school buildings. Children, instead of being forced to attend for eight or nine hours a day should spend no more than three or four hours in school, primarily to engage in social activities and sports. It is in school where they should learn to operate in larger groups, and where they are able to engage in certain specialised activities.

(b) Most of the skill learning which we associate with school now, such as reading, writing and arithmetic, should be done at home in front of an intellectual television set. This television set would be hooked up on a closed circuit to the school, where pre-programmed assignments may be entered. It would also be hooked into a computer network which has access to global library facilities. A student required to study World War II for example, could spend much of his or her time looking at actual film footage of the various aspects of it. It may be that the technology will have advanced sufficiently so that television will have moved to three-dimensional holography, which, coupled to remote control systems, would enable the student to examine live specimens in biology, for example. In general, students will have at their disposal knowledge resources as different from what we have today, as the knowledge we have today differs from what was available to the mid-Victorian schoolchild scratching away on a tablet. The major advantage of the television technique is that not only would it bring into the students' home global knowledge resources, but the students would be able to assimilate and digest this knowledge at their own pace. The programme for learning skills such as reading or writing would utilise the best pedagogic technology: it will be great fun ... learning will be a game each individual plays with the machine, not a competition against other individuals. Furthermore, intellectual machines have infinite patience and are always designed to lose, for it is the student who must win as he or she learns.

(c) It is not enough, however, to expose students to a few hours of school and a few hours of electronic study. There is a great need for the human touch, in particular for the young children. I envision the totally under-utilised resources of older people to be crucial here. A whole horde of grandmothers and grandfathers should be unleashed on the educational system to greatly enhance its creativity: older women and older men should be assigned to a small group of three-year-olds with whom they stay for ten or fifteen years at a time as a sort of explorer guide. They would of course have been trained in the operations of the global knowledge system, and in meeting the needs of small, then middle-aged and finally teen-aged children. Here, older people, will provide not only an intellectual function but also, as surrogate grandparents, a strong emotional function. Incidentally, there is every reason to believe that the major biological function of grandparents is to instruct the young: the old teaching the young is a process which comes naturally to the human species.

Thus, the children and teenagers of the future will be educated in a system which includes reduced periods in the traditional schools, devoted primarily to social and physical activities, will learn intellectual skills at their own pace through their home electronic media, and will meet in small groups with their grandparent teachers. It must be clear that such a system will mean that the primary economic activity of the society of the twenty-first century will be its education industry. It will probably utilise half or more of the labour force and perhaps at least half of the gross national product. The question is, of course, how can a country afford this? The answer is simple: the new knowledge will be (and has been) creating new technologies which increase levels of productivity (wealth creation) to undreamed of heights. Two hundred and fifty years ago 95% of the labour force worked on farms to support the other 5%. Today in the United States less than 5% of the labour force works on farms. It supports not only the other 95%, it feeds much of the rest of humanity as well. The same process which occurred in agriculture, i.e. which has happened to the primary sector of the economy, is happening today in the secondary sector of technologically advanced economies. The next generation may find it needs no more than 10% of its labour force to provide it with all the material goods needed. The primary activity then will become education, health and social care. The new productivity would provide society with the wealth needed to sustain these other sectors of society. The trick in achieving a smooth transition is to understand where we are going, and to look for economic doctrines relevant to the twenty-first century, not to the nineteen-thirties. Neither Marx nor Keynes, nor for that matter Adam Smith or Ricardo, had the experiences of watching the economy change as a result of the electronic revolution. We must develop new doctrines, new policies, and set our goals towards a world in which the major human activity will be to take care of each other.

CHANGE IN BRITISH INDUSTRY

Chairman
Dr. W. H. Darlington

Speaker
Mr. Kenneth Owen
Technology Correspondent
The Times

A handful of microcircuits may not look very substantial, but they and a range of devices like them are revolutionising industry, commerce, and many areas of everyday life. This handful is the equivalent in processing power of a fair-sized computer centre not too many years ago.

It could be called the semiconductor revolution, and it began about thirty years ago with the transistor. Now a single microcircuit can carry, on a tiny chip of silicon, the equivalent of many thousands of transistors. And a particular type of microcircuit, or assembly of a few individual microcircuits, can be programmed to act as a computer. It is called a microprocessor or microcomputer, and it is at the heart of many of the most significant areas of technological change at the present time. And not just in data processing, though that is the key to many other areas.

Though the small size of the microcomputer is remarkable, this is not the main point. In data processing, as in other areas, the main point is reliability and low cost. You will need a terminal for input and output of data, probably extra data storage beyond that carried on the micro, possibly a printer unit, and so on. So this surrounding hardware, the peripheral units, will set the size of the complete system.

This extra hardware will set the price of the complete system, too. But the cost of the basic microprocessor is so dramatically low - about $5 or £3 for a quite powerful one at present - that completely new approaches to data processing are now possible.

The pace of the advance in technology is such that every year your $5 will buy you roughly twice as much processing power. People tend to quote prices in dollars because the mass production of microcircuits is virtually an American monopoly, or rather American and Japanese monopoly, at present.

One application of microelectronics and microprocessors appears in new versions of old products. This is a digital, handheld micrometer, designed by the Technology and Science Centre of PA Management Consultants for Moore and Wright of Sheffield. It combines microcircuitry with an advanced optical system to give the measurement in a digital display using light-emitting diodes. It will take 500 to 1000 measurements before the battery needs to be recharged, and it costs about £100. It is accurate to one-tenth of a thousandth of an inch; as you can see, it is easy and quick to use.

Consider the implications for automating the operation of machine tools and many other mechanisms, and the process of inspection, by building-in versions of this device.

Starting as an electronic version of an existing product, the electronic calculator rapidly built up a completely new market in its pocket-sized models. What emerged was a completely new product. Only five years ago a pocket calculator able to add, subtract, multiply and divide sold for £80. Now you can buy the same four functions, plus a little more, for £4 in Woolworths.

Mass production of the microcircuit chips is the reason for the dramatic cost reduction. Literally millions of pocket calculators are sold in Britain each year, and the available designs now include a wide range of more complicated scientific and business calculators.

Also some unusual hybrids - this is a combined calculator and ballpoint pen. If you can add a calculator, a basic computer, to a ballpoint pen you can add it to anything; again there are implications in many walks of life.

The impact of microelectronics can be seen, and used, in new products such as these and in many other items of home, office and factory equipment. Digital watches, television games, processor-controlled washing machines, dishwashers and cookers, a whole new range of business equipment, other professional equipment including medical and communications systems.

The change to microelectronics has been accompanied by significant changes in the structure of the industry. The role of the component suppliers has become more powerful as the power of their integrated-circuit products has increased. Now the semiconductor companies are supplying not components of circuits but complete circuits, and not just complete circuits but complete processing systems, all on a chip or two of silicon.

Not surprisingly, some of them have themselves integrated vertically, moving up to design, assemble and market the calculators, watches or whatever that are wrapped around their microcircuits. Not all of them have succeeded.

From the other end of the spectrum, some of the manufacturers of large electronic systems have extended downwards to build up or acquire an expertise and production capacity in microelectronics. Not all of them have been successful, either.

And a new industry, or sub-industry, has emerged, based on "systems houses" which buy in the micro components and other hardware, write the software, and design and market the complete systems. Note the word "software"; it is very important and I shall try to explain why a little later. The products of the systems houses range widely; they include both business computing systems and industrial process control units.

For small business computing systems, a new supply framework is envisaged for the future, when the volume of these micro-based systems could reach hundreds of thousands a year. There would be national parts distributors and national systems retailers, who between them would supply local parts shops, systems and software houses, maintenance companies, bureaux, local systems shops and end-users.

The telecommunications industry is undergoing a painful transition from electromechanical to electronic manufacture as digital methods of switching and transmission move in. Here the space saving offered by the micro-miniaturized equipment is important. Switching equipment in telephone exchanges will take up only one-fifteenth the space, so that there will be savings in buildings and installations as well as in manufacturing cost.

Redundancies have already hit the three main telecommunications companies - GEC, Plessey and STC - as this change from traditional electromechanical switching technology begins to bite. But, in the words of my former colleague, Peter Jay, in a different context, things will get worse before they get really bad.

Kenneth Corfield, Managing Director of STC, illustrated this at a recent electronics conference. The number of direct operatives required to produce the equivalent of 500,000 lines a year - a measure of switching output - was 3,250 for electromechanical types. "Already we are well under way with the first transition", he said, "which reduces the number of direct operatives by a factor of 2.6" - that is, to 1,250 people. This transition is to semi-electronic equipment.

The next transition will be to the so-called System X, an all-electronic design for the 1980s and 1990s. "If properly implemented" - these are Mr. Corfield's words - this next stage will bring about a further 10:1 reduction in labour applied at the production stage. That is from 3,250 originally to 1,250 and then to 120 people.

Another assessment of the impact of new technology on telecommunications was given recently by Dr. G. Zeidler of Standard Elektrik Lorenz. He looked at communications products of three types - based respectively on electro-mechanical components, standard integrated circuits, and microprocessor technology. He showed that, in going from the first to the second to the third of these, the cost of materials had risen from 30 per cent to 50 per cent and then to 80 per cent of the total. Labour cost dropped from 20 to 15 to five per cent; and overheads from 50 to 35 to 15 per cent.

For the same three categories of product, also, there were changes in the personnel who made, mounted and maintained them. They consisted of semi-skilled workers, skilled workers, and the higher-qualified engineers and technicians. Here the proportion of skilled workers dropped from 80 per cent to only 35 per cent, while the proportions of both semi-skilled workers and qualified engineers increased.

Both Mr. Corfield and Dr. Zeidler belive that the decrease in manpower requirements which is being forced on the telecommunications industry can be stopped, or at least alleviated, in the long term by exploiting new market opportunities and by developing and producing new equipment.

Certainly the new technologies are opening up new opportunities which can be exploited, both by the older-established large companies whose traditional markets are being hit, and by new, small companies, Here are two examples.

Plessey Semiconductors at Swindon are exploiting a concept, familiar from school physics examinations, known as the piezo-electric effect - the interaction of mechanical and electrical effects in certain materials. They are producing what are known as surface acoustic wave or SAW devices which can replace complicated circuits in radars, television sets and other electronic products. In television filters, a single SAW device can replace a complicated circuit of discrete components including perhaps six coils needing to be tuned individually during assembly. The SAW filter needs no adjustment.

Plessey has claimed a world lead in going into production with SAW television filters. But, to cope with the rapidly expanding demand, I believe the company was planning to follow its integrated-circuit practice and use a Hong Kong source for the assembly of these filters, with Swindon concentrating on fabrication and testing.

A less familiar name is Micro Consultants of Caterham, Surrey, who have specialized in the digital processing of video signals. The information contained in single frames of colour television is stored on microcircuits, and can then be converted from one standard to another and manipulated in various ways.

The television producer in the studio can now zoom in, zoom out and follow objects in the picture in the same way that the cameraman can. He can edit out anachronistic items such as microphone booms or background telephone kiosks in historical productions, and achieve many special effects.

And, combined with the power of a minicomputer, the same techniques can be used to improve the quality of medical X-ray pictures, to produce better Photofit pictures for the police, and for traffic control. In traffic control, it would be possible (but expensive) to develop a system in which a television camera would automatically track particular vehicles and, if necessary, display their speed.

These are all new products, enabling things to be done which were impossible before.

These are some of the ways in which changes in electronics technology are affecting the traditional electronics and telecommunications industries. They are affecting other industries, too.

Automation of mechanical processes is an obvious example, and one where the extent of automation in a particular factory or firm clearly is not determined simply by the technology nor the available investment but by the attitudes of management, the workforce, and possibly the public and the government. The limiting factor is not technology, but the degree of acceptance of change. Automation can improve a company's competitive position, and can remove the need for people to work in hot, noisy or otherwise polluted conditions, or in boring jobs, but the impact on the numbers employed may be dominant.

In Japan, the high degree of automation in the car industry is just one sign of a determined national attempt to develop, use and sell advanced systems of automatic control. There are literally hundreds of companies in the business of industrial robot systems, some simple, others very complex indeed. We are familiar with automated chemical process plant which appear almost deserted when in full operation; there are sections of Japanese car factories which are moving the same way.

In the banking industry, the new technology is making possible radically new styles of business and management. One large New York banking house has gone from one extreme to another in its harnessing of computer power. It has abandoned the large central computer. It has developed and adopted literally several hundred mini and microcomputer systems, some of them used by groups of only a few people. The individual computer will become feasible - provided the problems of this strange thing called software can be solved.

Software is important, yet often misunderstood. It is a new concept, basic to all computer systems, but often, it seems, not understood by all when government bodies discuss industrial strategies, manpower policies and the like. A computer is just a useless box of hardware until it is told what to do.

Computer programs or software are simply the instructions written by humans to tell the machine how to work and what to do. As with human languages, there are many different computer languages, so there are complications of translation from one to another.

And, just to make it really difficult, it is impossible to test in advance all possible combinations of conditions which the program will handle, so that no program can be guaranteed foolproof. When faults or "bugs" in software occur, fixing them can cause further errors, and so it goes on.

Not surprising, then, that as the cost of hardware continues to drop, the cost and complexity of the software continues to rise. Getting the software right in fact will be a key problem in the successful introduction on a mass scale of the new micro-based systems.

Thus we have a new discipline, a new industry, a new group of people who are to a large extent responsible for shaping the patterns of technological change. They design systems, write programs, sit at computer terminals to develop and test their programs. They are at the point of contact between the user's problem and the solution which they hope the computer will give.

They may work in large teams or in small groups, for computer companies, computing companies, software and systems houses, or computer-using organizations. They are not inhibited by traditional industry structures; they are used to flexibility and change. Key people. If we use them aright, it could make a big difference to our national industrial performance.

A small example of what software is. You may be familiar with this Sinclair programmable calculator. It costs about £15 in the shops and you can programme it to do a variety of calculations. This little thing is the hardware. These four books represent the software.

In the wider sense, we can use the term software to include all or most of the non-hardware aspects of industry - from design to the many new areas of information services. Again, most important for any region or country in preparing for technological change, since these are the people and services that are shaping that change.

From the industry side, let us move to the world of the people who, at work or at home, will use the products and services of the new technology. Already they - and that means we - are starting to be faced with new ways of doing things, some good, some bad. But this is only the beginning.

A new world of information services has already emerged and is expanding rapidly. Professional users include librarians, scientists and technologists who need to know about new developments in specialist fields of knowledge. Their problem is mind-boggling in its scale.

Over 40,000 separate journals on science and technology subjects are published each year, I understand, and 1,500 new ones appear each year. Three and a half million articles of various kinds are written and appear each year, and this is increasing at about eight per cent annually. New computer-based systems have been designed to cope with this deluge of information; new organizations have been created to provide access to the various specialist databases that have been created.

A trivial example of the principle involved. At a demonstration of the British Library's Automated Information Service recently I asked for a list of books published on home winemaking. This was the result. It happened to be printed out in this form; it could equally well have been displayed on the screen of a visual display terminal.

We are encountering the new electronics in our everyday lives. At the banks, the early rudimentary fixed-amount cash dispensers are being superseded by auto-tellers which, before they pay out money will check your account to see whether you have any. They will also display and/or print out your current balance, and accept requests for new chequebooks and statements to be sent on by post.

This is helping to relieve the counter staff of these routine tasks, so that they can concentrate on real banking. It has followed the initial round of bank automation several years ago, when large networks were set up so that branch accounting could be done by central computers.

Electronic cash registers in shops and supermarkets are increasingly linked to computers, also. The use of light wands to read coded price tickets is already with us in certain High Street shops; and we are moving steadily towards the acceptance on an automatic basis of credit-card or bank-card transactions at the point of checkout.

In these and other ways - at the counters of building society offices; at the enquiry desks of gas and electricity boards; at airline and other reservation desks - the general public is becoming more familiar with computer-based systems. The mystique is breaking down, as the input/output devices are deliberately being made easier to use by ordinary people. Paradoxically, this simplicity in use is being obtained at the expense of complexity in software, but that is not apparent to the user. In the future, the systems will be even easier to use.

For some users of computer databases, one consultant has pointed out, there can be significant changes in the content of the job. A travel agency clerk, for instance, previously had to know where to find the information he needed, and also how to make use of it. He was a knowledgeable individual, with a relatively scarce skill and a protected position.

Now, working at a terminal linked to computerized databases, the same clerk is in effect led through the process of obtaining and applying the information he needs by an interactive dialogue prompted by the computer. He needs only basic skills. He has become a part of the system more completely than ever before.

These are some of the changes that have happened already. In the near future a new range of services and uses will grow up around the television and telephone in the home. The Post Office's Viewdata scheme is designed to link the two, television and telephone, to provide dialled information services. Outside organizations will provide directory-type information - the Good Food Guide, perhaps, and airline, bus and train timetables, etc. - which will be held on file at Post Office computer centres.

Using a calculator-like keypad, the user will dial-up the service he needs, and the information will be displayed on his television set. A market trial involving 1,000 Viewdata sets will begin next year.

A second phase of Viewdata is likely to include the ability to dial-up a friend (or enemy) and leave a message - the Post Office is banking on a great demand for "Delayed at office" type messages from husbands to wives - and the ability to follow through an airline flight directory enquiry, for instance, with a firm booking. This would be done by keying in your Access or Barclaycard number.

Another new range of products is likely to emerge around the television set. Already we have the plug-in television games. Soon we shall have more difficult and more interesting games, as part of a family of plug-in, tape-based units whose cassettes will carry a wide range of programmes, including educational games for children and language courses, and including combinations of voice on the tape and graphics displayed on the screen.

Together with video recording, these various microprocessor-based devices will form a range of unit video products analagous to the present-day unit audio.

In parallel with these domestic developments, or quite possibly ahead of them, a range of business systems will develop. These will use the same technology but will be aimed primarily at specialized business information and communication services.

These are some of the ingredients that are shaping the changing pattern of technology. I cannot suggest how education should respond, but Sir Ieuan Maddock, the former Chief Scientist to the Department of Industry, has called attention to changes which appear desirable in the higher education of engineers. These stem partly from the way in which technology has advanced, and from its accelerating pace, and partly from the wider factors and new constraints which engineers now have to face.

The engineer of the future - and indeed many of those of the present day - will need to use a wide range of disciplines in his problem-solving, Sir Ieuan points out. The habit of segregating engineers into mechanical, electrical, chemical and other sectors is outmoded. Sir Ieuan confirms Professor Stonier's view that we shall need versatile generalists.

These are some of the ingredients that are shaping the changing pattern of technology ...

It is difficult to sum up; I have simply reported on some of the changes that are happening, essentially as raw material for today's discussion.

A major dilemma is now quite clear. Industry needs new technology to remain competitive. But the new technology brings automation and redundancies. And the new products often bring automation and redundancies to the user.

New specialist firms will emerge, particularly in the information industries and also probably in the energy industries as new sources are exploited.

Paradoxically, engineers may have to become generalists rather than specialists.

There <u>are</u> opportunities for new products, services, and jobs; but for many people in industry, unless something drastic is done, Peter Jay will be proved right:

Things <u>will</u> get worse - before they get really bad.

ATTITUDES AND ETHICS IN A TECHNOLOGICAL SOCIETY

Chairman
Dr. W. H. Darlington

Speaker
Mr. Kenneth Adams
Comino Fellow of St. George's House
Windsor Castle

It is a particular pleasure for me to have been invited to speak to this conference on Strategies for Change in a Technological Society on the theme of the attitudes and ethical factors which seem to me to be of particular importance in such a society. Let me start by telling you how I became deeply interested in this particular subject.

As Director of Studies at St. George's House, Windsor Castle, which appointment I held until March this year, I arranged in the early 1970's a series of consultations on two extremely important issues in our society. Many of us recognised that in a rapidly changing society where the thrust behind that change is technological advance and its effect on industrial and business philosophy, one of the areas which needed examination and review was the ethical responsibility of corporations - of joint stock companies, whether national or multinational. The same sort of question arose for those who led in the trades union movement. New power brings new responsibilities, and I believed that companies and trades unions had not recognised the new power which they now wield, and because they had failed to recognise that power they had not assumed their new responsibilities.

The second theme was closely related to the first, but it was concerend with the whole developing idea of the need for, and value of, fuller employee participation in the working situation, particularly with regard to our industrial life. These two series of consultations brought together people drawn from a wide variety of responsibility in industry, politics, the civil service, education, the trades unions and the church. Those developing consultations played their part along with the work of many other institutions, in developing the idea of the corporate social responsibility of business and of trades unions, and of encouraging much work in the area of fuller employee participation.

It was out of our work on those two themes that I discerned a third and I believe more important factor underlying both of them, and deeply affecting the whole way in which we in Britain view the work of those who engage in industry at all levels. It became clear to me that the development and maintenance of high standards of performance and ethical behaviour in any activity, requires to be supported by the attitude of society to that activity. Let me give you an example of what I mean. A society which believes in education will encourage those who teach to maintain high professional and ethical standards of conduct. It will encourage some of the best of the young to offer themselves for a career in education. A society which believes in the value of good health will encourage doctors and nurses to develop and maintain high standards of professional and ethical behaviour. The converse is equally true. I came to see that this was an important factor in Britain with regard to industry. Our society does not deeply recognise and affirm the value of the industrial activity, and therefore those who work in this activity, at any level, are not challenged or sustained by the attitude of society towards them as they try to develop and maintain high standards of performance and behaviour.

Out of the consultations on employee participation in industry, I recognised that there was a widespread desire among all the parties concerned for its development. There was no great body of employer or trades union opinion deeply opposed to the idea. The methods for doing this are quite well known and there are numerous examples in other countries of the successful development of this movement. I have come to see that one of the principal factors which holds up the fuller development of employee participation in the United Kingdom is, again, this question of attitude. When you think about it, it is a very simple proposition. People will only fully participate with their heart and mind in an activity which they recognise in one way or another to be worthwhile. That is worthwhile in its own right, like teaching or nursing. Now the great majority of people engaged in British industry, influenced by those who surround them who are engaged in other work, simply do not recognise the essential worthwhileness of the industrial function itself. They do not recognise that the fundamental social service in any society is the production of the goods and services by which it lives or which it produces in order to sell so that it can buy the goods and services which it cannot produce for itself.

These were the two reasons that moved me in 1974 to begin to concentrate on this central factor of the attitude of British society to the industrial activity within it. I saw clearly that a society which cannot, for whatever reason, recognise the necessity, value and virtue of the activity by which it lives, and therefore assume, affirm and indeed celebrate the value of that activity, must inevitably face a major ethical dilemma. You can't say 'yes' to your own future if you don't say 'yes' to the activity on which that future depends. That I believe to be our condition in the United Kingdom today. Sometimes it seems to me that as a nation we are like a family business when the new generation of the family no longer believes in the worthwhileness of the work in which the family is engaged and from which it earns its living.

Based on a paper which I wrote in 1974, we have held ten consultations at St. George's House asking the question, whether there is an adverse attitude to industry in British society, and if so, what is its cause or causes and what might be done about it. Those ten consultations have involved some three hundred people, drawn from a wide variety of background in our society and including, of course, people from industry and the trades unions. Those consultations have undoubtedly affirmed that, in their opinion, there is an adverse attitude to industry in British society and that this is a major contributory cause of our poor performance. This has been confirmed to me by the work of many other people, but also by an introductory paragraph in the recent Department of Industry discussion paper "Industry, Education and Management". Summing up what it calls "Britain's legacy", in paragraph 3 of that paper it says, and I quote:

> "Attitudes towards industry, and particularly manufacturing industry, are less favourable in Britain than in other major industrialised countries and are reflected in our educational system."

At our consultations we have been concerned to try to discover the main causes of this attitude. I believe that these can be summarised under four headings. Let me explain these to you as they have presented themselves to me out of our work at St. George's House and out of my own experience elsewhere.

First there is what I would call the effect of the attitude of educators and our educational style. Let me quote Sir Alex Smith, speaking to the National Union of Teachers in January this year on the attitude of educators:

> "I want to talk now about the deeper longer-term problem of the relationship between education and the well-being of the nation. There is a divergence between education and the means whereby we as a nation earn our living, and it increases as the education reaches its higher levels. Many educators dislike, to the point of contempt, the activities, and the values, of the industrial sector. They see it as having little respect for human values, little recognition of human attributes, committed only to rising production heedless of value, unconcerned about the extent to which people are dehumanised or the earth's resources are ransacked in the process. They see it as dependent for its success upon pandering to the baser human emotions of greed and envy, and they recoil from the unrestrained consumerism which is so assiduously fostered in order to sustain the industrial productive system."

Again, if I can quote from the Department of Industry paper, it is said that:

> "Britain has a two-culture system based on the distinction between arts and science, whereas continental society distinguishes a third culture in Technik (or the art of making things)."

We speak of people being literate and we speak of people being numerate, but we have no word to describe those people who excel in the art of problem solving, planning and carrying into effect their plans - of making things happen. Indeed, of making things.

This whole question has recently been aired brilliantly, in my opinion, in the lecture given by Dr. Patrick Nuttgens to the Society of Industrial Artists and Designers on the 5th December. It was necessary for him in that lecture to define what he meant by technology. He argues that a myth has grown up in the last few years, that applied science and technology are the same thing. He believes that that was probably the result of the status system which gives higher status to science than to technology. This meant, and I quote from his paper, that:

> "Rubbing shoulders with science would give technology a little more respect in the academic world."

But he goes on to argue, and I believe this to be of central importance and therefore I quote:

> "Technology is not Applied Science and never was - for the simple reason that it started differently. The origins of technology lie in the solving of practical problems. In that sense the great engineers - Telford and Stephenson, Brunel and Brindley as indeed the leading engineers of today, whose work includes some of the greatest wonders of our time - were practical men with a massive dose of common sense, enormous energy and the ability to devise ingenious solutions to definable problems. Their work arose initially not from the application of scientific theories and principles to a practical situation, but the opposite. It was the solution to problems that provided the material from which to deduce a scientific principle."

> "..... technology is an activity in its own right, with its own bases, objectives and skills, not inferior to science, and, for us as citizens in an advanced society, of crucial immediate significance."

In this short talk I cannot, of course, do justice to the argument which Dr. Nuttgens has so splendidly developed in that published lecture.

Central to his view is the relation of design and manufacture as one process. To quote again:

> "..... and that is something (that relationship of design and manufacture as one process) - is something which, however many thousands of times it has been reiterated and preached, seems never to stay at home in the mind; and it is precisely there that much of the industrial weakness of this country rests. The root of technology is creative ingenuity; and any system of education that ignores that and ignores ways of forming it is in itself inert and removed from the reality of our world."

So much for the educational factor. The second reason for our adverse attitude to industry seems to be the widespread ignorance which exists in our society about the basic function of the industrial activity within it. As a society we fail to recognise that it is by our industrial activity that we principally earn our living. There is still a widespread failure to recognise where the resources have to come from to support all the social services of our society, like education, health, defence, the police and so on. The main job creating, wealth producing, poverty reducing activity in our society is industry, linked with all the supporting commercial and other services which that industry requires, and yet many people seem to think that there is some bag of gold available for distribution by the Government or others in investment or reward, which does not have to be replenished by our industrial activity. Ignorance of the essential nature of the function of industry in this or indeed any other society, is the second great factor which sustains our adverse attitude.

Thirdly, there is the factor which I would call disenchantment with the ways of industry. By that I mean the ways in which we think industry employs people - the actual work which they have to do. We see it as boring, repetitive, noisy and dirty. Nothing revealed this so clearly to me than the letters received by the Guardian in response to the competition which they ran for schoolchildren in June this year on the them "Why work in Industry?". But we are also disenchanted by what we see or feel to be its priorities of production. We sense that non-essential goods are being produced in a world desperately short of essential goods. We are disenchanted by the wasteful use of materials, and by the pollution of the environment. And we are disenchanted by everything that is caught in Edward Heath's now famous phrase "The unacceptable face of Capitalism". There is of course some truth in all these charges. But it is important to remind ourselves that unfortunately sin is a universal factor in the human condition and is not confined to those who engage in industry or commerce. This does not mean that we should be complacent. It means that we have vigoursly to develop systems which critically examine all these ways of industry and suggest and support better ones. Nevertheless, let me make my main point here, as I did earlier, that those who seek within industry continuously to improve the ways in which it performs its essential function, require the moral support of the whole of society in doing that, and require the affirmation by society that the activity itself is worthwhile. Do let us remember that unless you

believe an activity to be worthwhile in its own right, you will not feel it worthwhile to devote your time and effort to its continuous improvement. An activity which isn't worthwhile is not worth criticising - much less getting into and changing it yourself.

Lastly, in these reasons for the existence of our adverse attitude, I would list what I can best call disappointment with results. Industrially, Great Britain seems to have been doing badly for a very long time. Our place in the league table has been slipping and it is perfectly understandable that people are unlikely to commit themselves, if they have some choice in their career, to an area of work in our society which seems to be depressed and depressing. Success breeds success and failure, I am afraid, breeds failure. Of course there are numerous examples of excellence in British industry, but we are talking of general impressions and general trends which impact on the minds of those who form opinion in our society, including every parent and every teacher.

So I think you can see what I mean when I argue that we find ourselves in a vicious circle or, more dramatically, a vicious descending spiral which speeds our industrial decline. It works like this: the low esteem of the industrial activity leads to poor recruitment to that activity, that poor recruitment means that the best in skill, dedication, wisdom and creativity are not available within the industrial sector. That reduction in the availability of talent leads to poorer performance and that poorer performance itself feeds the low esteem factor, and so the vicious spiral continues. Now how do you break into that vicious spiral and change it from being vicious to being beneficial? How do you reverse the order of that spiral and make it ascend instead of descend? Well certainly, it seems to me, that every point in the circle has to be attacked. We have to attack all the factors which I have set out as tending to create that attitude - our educational style - the ignorance in our society about the essential function of industry - the disenchantment with the ways of industry by correcting those ways - and the disappointment with industrial performance by improving that performance. But in any process it is important to try to discern the key factor, and it is here that I want to move to what I shall call the moral imperative.

I believe that the starting point of breaking into and reversing that vicious spiral is the encouragement of the recognition of the essential ethical function which industry performs. It is the activity in any society which produces the goods and services by which that society lives - it produces its "daily bread". But not only its own "daily bread". It is the activity out of which, and out of which alone, we can make a contribution to the needs of others in our own society or in other societies throughout the world. No-one can consume that which has not been produced, and no-one can give in material terms that which has not been produced by their own, or by another's, industry. The fundamental social service which industry provides in our society is not recognised as such. It is this recognition which we have to awaken.

A regional director of Oxfam told me that she is approached week by week by excellent young people working in industry, who say to her that they want to give up their industrial work and devote themselves to the 'good' work of Oxfam. She spends a lot of her time explaining to them that if they did not do their good work in industry there would be no Oxfam for them to support.

We need to open people's eyes to this recognition of industry as the poverty reducing activity in society. In a world of vast and growing material poverty, faced with a doubling of its population in the next thirty to forty years, and furthermore faced with a situation of depleted resources some of which are finite, there is no greater moral challenge facing us than the industrial task of producing the food, shelter, clothing and medical care required for that population in world terms. It is a question of production and distribution, both of which are industrial activities.

I cannot go down the road with those who would argue that we in Britain should revert to some simpler life-style based on a peasant type of society, producing our own food and resources. Even if that was possible, which in this island with a population of fifty-six million I do not believe it is - but even if it was, that can be no proper way forward. It cannot be right to develop embattled islands of self-sufficiency in a world situation of great and growing material poverty. We have a much greater contribution to make than that.

So I start my own attack on the vicious circle unashamedly by a re-statement of the moral imperative and, indeed, the moral duty of man to provide the material things which he requires in goods and services for his own survival and his own delight, but not in selfish terms of producing simply enough for himself, his own family or even his own nation, but in providing enough for all men everywhere. That is a worthwhile task. That is something in which, in my opinion, our young people and our not so young, will readily commit themselves.

British attitudes can and do change. If you need a reminder of how those attitudes have changed in the past, I would direct your attention to nursing. Remember that in 1850 nursing was not a profession, it was work pursued by women who could get no other work. What nurses and nursing was like was demonstrated in the gin-sodden character of Mrs. Gamp in Dickens's "Martin Chuzzlewit". By 1875 in a period of twenty-five years, that attitude had changed. A profession had emerged. The quality of nursing had immeasurably improved. The best of our young people offered themselves for a career in nursing with dedication, and all that was the work of one great woman who fundamentally recalled people to the moral imperative of the care of the sick, and showed them how to do it.

That is what we need today. It is almost Christmas, and we will be singing, or will have sung, with Good King Wenceslas, "Bring me flesh and bring me wine, bring me pine logs hither". Let us rejoice and thank God for those who farm and produce the 'flesh', our food, those who manufacture and provide the 'wine' and all the other manufactured necessities and delights of life, and those who extract and produce for us our 'pine logs' in the shape of coal, gas, oil and electricity.

There is no more virtuous, no more moral task in which a person can engage than the job creating, poverty reducing, wealth producing work of industry - farming, manufacture and extraction and all their supporting industrial and commercial services. It is our basic and most important social service.

EMPLOYMENT AND TECHNOLOGICAL CHANGE

Chairman
Professor K. Austwick
Head of Bath University School of Education

Speaker
Mr. Colin Barnett, Secretary,
North West Regional Council of the TUC

Owing to a car accident, Mr. Barnett's paper was read to the conference by Dr. R. L. Page, Chairman of Conference Steering Committee.

Introduction

The current recession, and the high levels of unemployment associated with it, has prompted many studies of the Labour Market. This paper attempts to examine the relationship between unemployment and technological change.

There is growing concern that technological development, although vital to economic survival in a trading nation, is leading to a decline in employment opportunities, at least in the short to medium term.

The aim of this paper is to examine this proposition, and to discuss some of the measures that may be taken at both national and regional level to tackle the problem. The paper does not attempt to discuss all aspects of unemployment, in fact the main emphasis of the paper is on "technological unemployment".

Technological Unemployment

Technological unemployment can be defined as unemployment that is generated by changes in techniques of production. New technology may be of a labour-saving character, enabling a smaller work force to produce comparable, if not greater levels of output, compared with the techniques replaced. Thus the introduction of labour-saving technology can create a situation in which levels of output grow, but with a diminishing labour force, and is therefore accompanied by increasing unemployment.

The standard economic analysis of this problem would admit it only as a temporary adjustment problem. At its simplest (and at the risk of over-simplification) the argument would be that the workers displaced by technological advance will either be re-absorbed by the same industry at higher levels of output and productivity, or by other industries which grew up with the rising prosperity of an economy based on high technology. The main problem with this analysis as far as policy makers are concerned, is that the adjustment period may be longer than the policy makers are prepared to accept. If we take a long-run view of the development of industry, we can see that technological advance in the last hundred years or so has enabled productivity growth not only to increase output, but also employment.

However, it was Lord Keynes who impatiently reminded his colleagues that "in the long run we are all dead". High levels of unemployment for long periods are economically and politically unacceptable in the post-Beveridge era.

Therefore we need to ask, what are the grounds upon which the present concern is based? We refer back to the thumb-nail sketch of the economic analysis above. It is evident that one of the conditions for the absorption of workers displaced is a growing level of aggregate demand in order to call forth high levels of output that need absolutely, if not relatively, more workers. However, it is by no means certain that even rising levels of aggregate demand will be sufficient to generate increased employment opportunities. For example, despite the fact that output from manufacturing industry is now 30% higher than it was in 1963, there are now over a million less people employed in manufacturing industry (1). Furthermore, the industries in which output and investment have been above average, have also experienced an absolute fall in the number of workers employed. This is well illustrated by the Chemical and Oil Refining sector. Investment in plant and machinery has increased by 81% since 1963, output has risen by 96.2%, but employment has fallen by 19,000 (2).

It is the case that within each major sector of manufacturing industry there are now less people employed than in 1963 (3). Clearly this is in part a reflection of the recession, but it also indicates that the process of technological change has significantly reduced the absolute demand for labour by manufacturing industry.

Taking a long-term view of this process it can be seen that as employment in manufacturing has declined, employment in the service sector has increased. However, even within the service sector there have been significant changes.

Employment in the service sector is being affected by the recession and possibly by rationalisation. For example, in the distributive trades from a peak of 2,767 thousand in December 1974, employment had fallen to 2,655 thousand by June of 1976 (4).

Recent figures also indicate that employment in the Local Government sector has fallen. Between September 1975 and September 1976 the number of people employed in Local Government fell by some 24,916. This trend is likely to continue with increased pressure on Local Authority budgets (5).

Against the background of the Government's present economic policies, and the likely economic developments, there would appear to be little prospect, at least in the short to medium term, of displaced workers being absorbed. Thus the evidence would appear to confirm the current fears that the technological element in unemployment is a problem, and likely to remain so for some time.

Furthermore, if it is accepted that the present high levels of unemployment cannot be explained by cyclical factors alone, but that the totals are composed of more deep-seated elements like technological unemployment, it follows that it is not enough to press for macro-economic policies to stimulate the economy, but it is necessary to look at more radical approaches.

It may also be the case that significant regional variations exist. The older industrial regions being those areas which require more modernisation could therefore be especially vulnerable to the processes described. If further research were to show this to be the case, then a strong regional element would have to be built into any package of proposals that were developed to tackle the problem of technological unemployment.

Approaches to the Problem

Two broad areas of approach can be considered, and could be termed the "work sharing approach" and the "job creation approach". Both these approaches involve costs. The CBI in its document "Road to Recovery" ruled out the work sharing approach to problems of unemployment on the grounds that, among other things, it would cost "vast sums of public money". However, it is important to bear in mind throughout this discussion that unemployment also carries with it high costs, not only to the individual unemployed worker, but it also costs "vast sums of public money". £823 million was paid out in unemployment and supplementary benefits to the unemployed in the period 1975-76. This represents a direct charge on the Exchequer, and as it represents a transfer payment from the employed to the unemployed, is a real charge to the economy.

There are also other costs to the Exchequer, principally the loss of tax and national insurance revenue. The NEDO has estimated that taking these factors into account a worker could be subsidised, in a job, by up to £25 a week before causing a net loss to the Exchequer (6).

Put another way, the cost of unemployment in benefit terms alone is the equivalent of just over 3% of the contribution to the GDP made by manufacturing industry, and on the basis of the NEDO figures the costs are the equivalent to some 5% of manufacturing industries' contribution to the GDP.

The Work Sharing Approach

The work sharing approach would include elements such as a shorter working week, longer holidays, and earlier retirement, and possible increased opportunities for full-time education at all ages. This latter point will be left out of this particular discussion as it raises many more issues than the other items. Historically, as we have already noted, working hours have been reduced, holiday entitlements have increased, and in many occupations and professions early retirement has been introduced. However, in order to adopt this work sharing approach as a response to technological unemployment, this process needs to be accelerated.

Shorter working hours would need to be negotiated through the normal collective bargaining machinery, and may take a variety of forms. Hours of work can be reduced within the existing working pattern or different working patterns embodying shorter working hours may be introduced. Clearly the form that this would take is dependent on the nature of the industry and the work process itself, and for this reason, if for no other, a general campaign for, say, a thirty-five hour week, would need to be flexibly applied by each group of negotiators. Longer holidays are also a form of reducing working time.

Shorter working hours are a desirable object in themselves; however, in the context of this paper it is the employment generating effects of shorter hours that are of significance. Put crudely, the proposition is that employment can be increased by a reduction in the hours worked by those already in employment. This argument is often presented along with simple arithmetical illustrations, for example, if seven men currently working a forty-hour week worked only thirty-five, this would create an additional job. However, this simple arithmetic may be misleading.

Unless we make the highly unrealistic assumption that the seven employed workers will be willing to accept a reduction in earnings, the hiring of the extra man will increase the total wage bill. Therefore, unless the employer is able, or can be persuaded, to accommodate this increased cost by accepting lower profits, his response will be to seek to raise productivity. If the demand for output fails to grow at a sufficient rate, increased productivity may lead to a reduction in the demand for labour. Returning to the simple illustration, the result of a reduction in hours may be that the seven continue in employment, work shorter hours at a higher level of productivity, but that the employer does not in fact recruit extra labour.

However, the absolute increase in the wage bill does not necessarily imply a rise in wage costs per unit of output. In the U.K. normal and actual hours fell significantly in the periods 1959-61 and 1964-66, and one study has concluded that "wage costs per unit of output rose less rapidly in those periods than in the equivalent years of comparable trade cycles in which hours did not decrease to such an extent" (7).

This wage-cost effect may allow output to rise sufficiently to offset the relative decline in the demand for labour as a result of increased productivity and 'efficienty'. In the study referred to, the experience of a variety of European countries was examined and the conclusion was reached that "of the countries which have achieved most progress in reducing hours of work, Austria, Luxembourg, Norway and Sweden have maintained exceptionally good low levels of unemployment" (8).

Taking these factors into account, reduced hours of work may make some contribution to reducing unemployment, but the issue is not as clear-cut as is suggested by the simple arithmetic. It has been suggested that to achieve a uniform thirty-five hour week in the U.K. a reduction of 8½% in normal working hours would be required on average. This may generate an increase in labour demand of some 3½% or some 700,000 full-time jobs (9). One obstacle to this that has been noted is the possible time-lag between an increase in the wage bill and the rise in productivity and output that would offset this. In this context a form of temporary recruitment subsidy may be considered. It is a logical extension of the present temporary employment subsidy, which helps firms over recessional difficulties. This may be a fruitful area for further research, particularly in the North West where T.E.S. has been so significant.

Earlier retirement would appear to avoid many of the problems associated with the shorter working week. In essence the aim is to replace an older worker at present employed with a younger worker who is unemployed. The experience of the Job Release Scheme is of relevance here. The results so far have been disappointing and one conclusion that could be reached is that allowances or pensions will have to be more attractive if they are to appeal to workers other than those already unemployed or at the lower end of the wage scale.

There are two issues here. The cost of early retirement in terms of pensions or allowances, and secondly there is some evidence that significant numbers of workers do not want to retire early (10). In a recent study the Equal Opportunities Commission has estimated that to lower the male retirement age to 60 would cost around £2,000 million a year, and if all the costs were met by employed workers it would raise contributions by an average of £100 a year (11).

However, the net cost could be considerably less than this, if earlier retirement made an impact on the levels of unemployment and therefore reduced the costs of unemployment. Nevertheless such a major change in retirement age is perhaps not likely to occur in the near future, and it may be of more value to look at voluntary schemes, building on the experience of the Job Release Scheme.

Within such a scheme several options could be considered. As noted above, many older workers do not want to retire, and in many cases a wealth of experience and skill is lost to the labour force when the worker does retire. This problem could be met by an increase in part-time working. An older worker could be paid a 'supplement' by the State if a part-time scheme could be arranged and this would allow either a younger worker to be taken on part-time or work a full week with two part-time older workers. There exist some administration disincentives to employers at the present time, and adjustments would have to be made. However, these do not present major obstacles.

The job creating potential of such schemes is difficult to estimate. It will depend on such factors as the age structures in industries and localities and the match between this and the skills of the unemployed. There are approximately 1.2 - 1.3 million economically active men in the 60-64 age group and if only a fraction of these could be covered by early retirement or part-time schemes a valuable contribution could be made.

This discussion has been on a very general level, and much more work is required, particularly on the costing of various options. There is also an important area of work to be done in connection with early retirement/part-time schemes. A regional pilot study to examine the experience of the Job Release Scheme and to examine the potential for extending such a scheme would be of great benefit. Such information could be fed to Government, Employers and Trade Unions to identify areas where action would be most successful.

It is also pertinent to note that the schemes to reduce working hours, lower retirement age and so on have greater prospects of success in an expanding economy, so that even within the terms of reference of this paper we cannot avoid referring to national economic policies. The policies contained in the TUC's "Economic Reviews" and "Labour's Programme", may provide this framework of expansion, but essentially that is another discussion.

Job Creation Approach

Two facets of a job creation approach in its broadest sense may be considered. Job creation in the manufacturing sector, and job creation in sectors outside manufacturing. This latter covers not only the fields of service industries, public administration, etc., but also some of the newer areas that have been highlighted by projects funded through such channels as the Job Creation Programme itself. The list is extensive and includes such items as community projects, Advice and Welfare Rights work, play facilities, conservation teams and many other areas.

At the present time the Job Creation Programme is providing somewhere in the region of 41,000 jobs at a cost of £55 million (12), which is an average of £1,300-£1,400 per job. More resources would be needed if a more long-term scheme were envisaged, although it is clearly part of official thinking to try to establish projects which after an initial period of assistance, would have some prospects of long-term viability.

This area is dependent on resources being made available from the manufacturing base, and it is to this area that we turn next.

The prospects for job creation in the manufacturing sector would seem on the surface to be extremely limited. It could be argued that any viable enterprises that could be launched would be launched by private industry, and unviable public sector schemes would be a mis-allocation of resources.

A possibility in this area would be to investigate the viability of a co-operative development agency, which would encourage and assist the setting up of workers' co-operatives. The problem that has to be confronted however is would Workers' Co-operatives necessarily be more viable than either assisted private companies or public enterprises? There is a fear that one of the conditions for success for a Workers' Co-operative scheme is that the workers are prepared to accept worse conditions of employment in terms of hours, flexibility, wages, etc. than in related private fields. A judgement has to be made by the workers involved and policy makers on the desirability of this course of action.

Within the constraints of a fixed level of aggregate demand, opportunities for job creation are limited, although in a situation with some growth in markets, which allows room for alternative forms of productive organisation, the channelling of resources into these forms in order to generate employment opportunities, could be viable.

Government Agencies

The approaches discussed have involved some government response. For this response to be effective it needs to be an organised response, that is, there is a need for government assistance to be channelled through a responsible agency (or agencies), rather than the government taking a series of ad hoc decisions as individual problems arise. Therefore we need to briefly look at the existing agencies of government in the area of economic planning.

We will discuss three main areas of the Government's planning machinery; these are concerned with (a) Company level intervention, via the N.E.B. and Planning Agreements, (b) Industry level, through the Industrial Strategy with NEDC and the D.I., (c) Manpower Planning with the Manpower Services Commission and the Department of Employment. There is considerable overlap and 'interaction' between the areas, but it will be convenient for the purpose of this discussion to make these divisions. Furthermore, this is not an exhaustive analysis, merely a brief review.

The N.E.B. was envisaged by the Labour Party, as a major instrument of economic policy. Labour's Programme 1976 states that, "its role ..... is to provide jobs and new investment, especially in the regions, to give a major boost to exports and import substitution, and to help the government deal with multi-national corporations on a more equal basis" (13). The Government, on the other hand, would appear to have a more modest role for the N.E.B. in mind.

The Government, however, seems to place more reliance on its 'Industrial Strategy', which involves sector working parties, the NEDC machinery and the intervention of the D.I. using its powers under the Industry Act. This approach has the advantage of looking at industry sector by sector, and the tri-partite form of the NEDC discussions allows full consultation to take place. Temporary Recruitment Subsidy, discussed earlier, could be considered within this context.

So far we have discussed aspects of the 'planning machinery' that has had its focus either at Company or Industry level. The Manpower Services Commission and the Department of Employment are concerned primarily with the manpower situation.

Training and the existing Job Creation Programme come under these agencies, and the MSC is developing into 'an authoritive centre of manpower intelligence'. A major input would be required from this source in any scheme to tackle technological unemployment. However, this part of the planning effort has to operate within the overall framework, particularly the framework being developed through the NEDC and the Industrial Strategy. Therefore these bodies are unlikely to be willing or able to take sole responsibility for the attack on technological unemployment.

Thus the main areas of the planning machinery all have contributions to make, but for this very reason it would seem unwise to charge a single agency with sole responsibility. This should not be regarded as a problem however. The issue of technological unemployment cannot be separated from the overall economic situation, nor can it be seen in abstraction from the detailed plans of public and private enterprises.

These remarks lead us to suggest that an inter-agency approach may be considered. This could be convened by a new body, or under one of the existing agencies. The NEDC may be a convenient vehicle depending on resources; on the other hand the D.I. or the MSC could take responsibility for convening an inter-agency effort. On the basis of our brief review, no firm conclusions can be reached, although some form of structured approach would seem preferable to none.

Some Concluding Remarks

The problem has been identified as one of accelerating the absorption of workers displaced by technological advance. Clearly there are many other issues associated with unemployment generally. There are cyclical factors, structural problems and problems of performance, - but this paper has been limited to an examination of unemployment and technical change.

Several approaches have been discussed as possible responses to the situation. Briefly the approaches have been:

(a) Work Sharing

(i) Shorter working week, longer holidays. Collective bargaining could be used to persuade companies to distribute some of the gains from productivity in the form of shorter working periods. The Government could offer temporary financial assistance to help companies overcome trasitional problems.

(a) (ii) Earlier retirement. Building on the experience of the Job Release Scheme, it may be possible with more resources to make a valuable contribution via this approach.

(b) Job Creation in the manufacturing sector. - The scope here appears limited, but one possible area is the encouragement of workers' co-operatives.

(c) Job Creation in the non-manufacturing sector. - Some scope exists in this area, but existing schemes would need to be modified and extended to promote projects with some prospects of long-term viability.

The Government needs to promote an inter-agency approach. The various bodies that have contributions to make need to co-ordinate their efforts and develop a unified strategy.

None of the approaches suggested are mutually exclusive (nor is the list exhaustive), a flexible strategy based on several approaches seems desirable. The precise 'mix' depends on further work to establish the costs of various options and estimates of the likely impact of the schemes. More work is also required to examine the available resources. Some relatively casual observations have been made in this paper on the 'costs' of unemployment, on the possibility of realising some of the gains from increases in productivity, but clearly a lot more needs to be done before firm policy recommendations can be made.

Finally, any strategy requires at least two conditions to be a success. First, resources have to be made available, and secondly there has to be the political will and judgement to match the resources to the needs. We have indicated that more work is needed to quantify available resources. The question of political will is outside the scope of this paper.

References

(1) Source: D.E. Written Reply No. 225 16/2/77 and Treasury Reply No. 250 16/6/77. Questions asked by George Rodgers MP and Ivor Clemitson MP.

(2) ibid

(3) ibid

(4) Source: Department of Employment Gazette.

(5) See Guardian 25/1/77.

(6) Quoted in N.W.I.D.A. Submission to A. Booth 4/2/76.

(7) Target 35 - The Case for the 35 hour Week by Jack Jones, p.8.

(8) ibid

(9) ibid Page 8.

(10) A recent survey by Success After Sixty, part of the Career Care Group found that half of these people over 60, who continue working after normal retirement age, intend to stay in their jobs indefinitely. Reported in the Financial Times 13/6/77.

(11) Sex Equality and the Pension Age - E.O.C.

(12) October 1975 - 17 September 1976, from "Towards a Comprehensive Manpower Policy", MSC.

(13) Labour's Programme 1976, pp 26-27.

REFLECTIONS ON THE DAY

Chairman
Professor K. Austwick

Speaker
Mr. Michael Harrison, Chairman, SCSST
Chief Education Officer, Sheffield

This conference, as with the first one, the Standing Conference sponsored in Yorkshire and Humberside, will leave through its local Steering Committee a legacy of report and recommendation and opinion. This, therefore, is not an isolated day but a link in a chain of events designed to produce change - which is what the Standing Conference, as well as stimulating thought, is in business for.

My function at this stage is now to try to convert the very wide-ranging experiences you have had today from Professor Stonier and other speakers to the point where you feel you can influence local decisions and begin to get things done. I think I can best do this by trying to relate the import of what our speakers have said to some major factors in our educational environment. Most of these factors are realities already and so I believe need to be accepted into the context against which local decisions and developments will be made.

But I begin with an observation. The general argument of Tom Stonier, the set of facts that Kenneth Owen spoke about and the references that Kenneth Adams produced seem to add up to a fantastic change in the manner of our society. The breathtaking electronic technological developments described to us are with us as fact, and they are going to be even more breathtaking I imagine in the next four or five years, with massive impact in the long term on our economic, social and may be political systems. Yet, as Kenneth Adams reminded us, all this is happening for us in a country in which general educational and cultural values for a long time back have gone awry in respect to the earning of our national living. Why we went wrong is a very interesting question indeed - far too complex for me to speculate upon today.

One expert commentator, the economist Michael Fores, whose view comes through strongly in the Department of Industry document "Industry, Education and Management", contrasts the way in which our culture moved into a bipartite division between arts and sciences when others, like the German for instance, retained and developed the idea and status of "technik". On the other hand, it is my understanding that in the 19th century there was a great deal of concern about the conjunction of whatever passed then for the education system and the world of work and science. There was a great movement to set up "modern" schools, with curricula relevant to the times.

I myself started my teaching career in a "modern" school which was deliberately set up by a charitable trust to complement a pre-existing highly academic institution in the same town. But that "modern" school became in the 20th century a grammar school, as classical and academic as all the rest. Why did that 19th century movement go wrong when evidently the people who were leading it had a very real feeling about what they thought Victorian Education should be doing?

And I suppose that the modern questions are: How do we avoid going wrong again? What new direction do we wish to move in? What modern factors do we need to take into account in our educational planning when we are thinking about relationships between schools and industry?

We desperately need to find the right answers to these questions if we are at one and the same time to meet the challenges of the future and eliminate the mistakes and missed opportunities of the past.

So let us look at some of the realities of the present, because it is with real not supposed elements that we must build our future and make our decisions.

In the first place we must assume a comprehensive - or as some would call it, a universal and integrated - secondary school system. The selective education idea is virtually played out in the UK, as in most other advanced Western societies, simply because it is not adequate (nor of course generally socially acceptable) to support societies demanding the highest possible skills through the whole range of their population.

Secondly, the theme of youth unemployment has come through very strongly in what everybody has been suggesting so far today. I think myself we need to be aware that the youth unemployment situation, with its huge dangers and huge handicaps, has become a matter of very great political concern both nationally and locally. The awareness perhaps is comparatively recent, but then the phenomenon is comparatively recent. We do need to know that Local Education Authorities are now very deeply engaged in erecting machinery of one sort or another through which they can relate to the Manpower Services Commission and the twenty-eight new Area Boards that are being set up all around the country to administer the Youth Opportunities Programmes of mixed further education, training and work experience. From now on there is scarcely a trade unionist or employer who will not be touched by this new, rapid and very powerful development. That represents a hugh tapping of personal commitment and influence by leading figures in local communities, and we need to get to know the character of the local manifestation of this and how to exploit it. We need to understand that the Manpower Services Commission has very large sums of money at its disposal, that the Youth Opportunities Programme is going to cost £168,000,000 a year once it gets going.

Thirdly, we need to understand that because the public education service in this country is highly decentralised and locally autonomous it is not allowed the opportunity for speedy development of programmes of its own such as the MSC is now developing. The rate support grant mechanism through which the whole of local government is financed is simply not designed to allow the system to move in unorthodox directions quickly; it is designed for a steady, assumed Victorian, state of affairs. There is in addition a very strong resistance in local government to steering by central government in any case. Local government professes to abhor the specific grant from central government. So we have the paradox that the public education service, because it is based in local government, is currently denied the opportunity of doing many of the things that it needs and knows it ought to do. Hence the MSC programmes which many people in my trade call an alternative further education system.

There are now in effect two education and training systems for the 16-19 age groups side by side, and the younger more moneyed system is competing with the other. Now this is a strange state of affairs because if all the things that Tom Stonier and his colleagues have been talking about are going to come to pass, the next stage of development must be the pushing forward of the frontiers of co-ordinated education and training so that we have a system that covers the whole of the 16-19 age group. In fact there are signs that the pressures for such co-ordination are rapidly building up in central circles of government and influence. But a new and rational system of administration and development will be achieved only through great stress, because behind it lies a struggle for power. In this process the consumer, the young unemployed, the school leaver, will be the sufferer because least considered. Schools and careers counsellors will need much resourcefulness and support in finding their way through this bureaucratic maze for the greatest benefit of their pupils.

Fourth, it seems to be the case that in the technological revolution now taking place, the young person in the 16-25 age groups is becoming progressively more difficult to employ. The unemployment statistics quoted to us today show up this disproportionate penalty in the unemployed totals. It has been suggested also today that our whole social attitude to work and non-work for the 16-25 age groups needs to be modified. Indeed if we do not succeed in changing attitudes and generating comprehension of modern conditions of employment, we may well incur the consequent revolutionary dangers arising from young people's sense of frustration and bitterness. Heads and teachers perhaps need to help them see the stage of their careers from the age of 16 onwards as rather different from the way it was looked at even only a few years ago - not as a stepping off the school platform into a different kind of world which is the world of work, but rather into an extension of opportunities in a spectrum of full-time or part-time education, in school or further education college, or training in an industrial skill centre, or work experience, or a mix of all these things. The implications of such a change of mode are considerable, for curriculum planning in school, for careers counselling and preparation, for continuity of education and training programmes across the 16+ divide, for co-operation between schools, further education and industry. "Education permanente" starts here!

Fifth, there has been today a cluster of comment and discussion on the general question of education for competence. This accords with the tone of the Green Paper. It is observable in schools today, which in my view have been very responsive to external pressures like these, that there is much thorough-going reappraisal of curriculum aims and objectives. Patterns of curriculum and syllabus content received from the world of the old selective style of secondary education (which itself was closely and quite anachronistically - beyond the early years of this century at least - associated with fairly primitive assumptions about manpower planning) are being looked at with a fresh analysis. The question is how to build a curriculum which educates for competence at specified points in a child's school career; the entailed question is how to define standards and values of competence and consequently what sort of curriculum design, what sort of core, what sort of commonalty one needs to have in the curriculum in order to meet the criteria defined. We are in a position now to find some good answers to those questions and this conference should be advised that this is absolutely the right time for interested parties outside schools to look for the connections by which they can join in the discussion.

One of the very interesting questions it seems to me following on from this position is what sort of attitude the school world, when it comes to its decisions about how it should re-shape its curriculum, is going to take towards higher education which always up to now has been assumed to be the natural end-on sequel to the secondary school. Should people go on thinking, if one is educating for general competence at 16 and at 18, that the relationship of the higher education world to the school system should be the same as we have seen it in the past? One observes that in other parts of the world, for instance in some of the States of Australia where they have the advantage of more manageably sized communities than ours, school systems have detached themselves from higher education systems, setting up their own monitoring devices and running their own certification processes from within. Echoes of similar developments may lie ahead of us here, with the emergence of a single 16+ examination, and the new N and F proposals designed to do away with the worst excesses of over-specialisation dominated by higher education.

My attention was caught by Kenneth Owen's comment this morning about the National Development Programme for Computer Assisted Learning and I am prompted to make a further point, on personal and individual learning. I believe NDPCAL, which has recently issued its report, was a very interesting event and we may well get much more mileage out of it in education than at the moment we understand. The programme was evaluated with great care by the University of East Anglia whose independent evaluation report when published is likely to say some interesting things about processes of learning at school and student level as a result of experience of interaction between students and computer. We heard this morning about the "emancipatory" aspect of a mode of study which, assisted by the computer, has access to vast quantities of ordered information. It would be premature to say that individualised learning systems energised by the computer and by Viewdata are going to sweep over schools tomorrow, but it is the case that already computer packages of material are available to schools, for example those developed by the Geographical Association and the Physicists. The possibility of radical new developments in learning systems and the organisation of learning in school is in fact already a reality.

Finally, we have found ourselves speaking during the day about the potential of people. In this country up until recently we have prided ourselves on our skill at developing means of assessment of people against the norm - I refer to our expertise in intelligence testing. But we have not been nearly so clever at judging the potential of people and then evaluating them against criteria peculiar and relevant to themselves. This I think is an important area of development because it relates very much to what the Assessment of Performance Unit at the DES is engaged in now and it also relates to the whole way in which a school may comport itself, work out its own objectives, and evaluate its own performance and the performance of the individuals in that school. Such a process of self-evaluation is likely to be the means by which schools in future will link their judgment of their performance to the wider national judgments produced by the APU. The APU is itself a government-backed enterprise which will attract a good deal of public attention and stimulate a good deal of sophisticated discussion about school and pupil achievement. It is vital therefore that all those questions of relation between the school and work and employment that have been occupying us all day should be pressed through the force of local discussion into the fabric of these emerging structures of objective and evaluation.

In conclusion I want to make a point about politics, and this is possibly the most practical and realistic of all the points I have tried to make in these remarks. Politicians were mentioned this morning. Yes, there are politicians in local and national government who need to be got at over the themes that we have developed today. That is one important and urgent task. I would like to make the observation though that all of us can function like politicians in a sense, if we determine to press an interest. One of the classic recent examples, I think, is the pressure that employers grouped together have obviously brought upon different aspects of government and maybe even the Prime Minister himself with the result that he spoke as he did at Ruskin College some time ago. He was exposed to political action of a sort, and the consequences came through in a highly political initiative from the Prime Minister himself.

The point I want to try to make is that while we have been talking and analysing today in an extremely rational manner, trying to treat rationally and systematically the enormous changes in society that seem to be occurring, the whole business of politics through which things have to be realised is not that sort of systematic process. It is rather irrational, and very much a process of negotiation. What you and I have to do is to sit down and think out in our own way, suitably to the circumstances of our own local environment, how to transmit the information and understanding we know to be rational (especially after this day's work) through in a negotiating situation to the politicians and others who control the course of events because they control resources. As the Chairman this morning said, "You have heard the arguments; now what do you want to do?"

OPEN FORUM

Chairman
Professor K. Austwick

IDEAS AND STRATEGIES FOR DEVELOPMENTS IN THE REGION

The following statements summarise the points made by various speakers during the brief discussions after each morning lecture that were chaired by Dr. Darlington, and those made during the afternoon's Forum chaired by Professor Austwick.

1. Emphasis on Industry in Secondary Schools and Higher Education

Several speakers suggested that as the unemployment situation worsens, so does the needed entry of able young people into industry. More effort must be given to matching young people to the vacant jobs and careers in industry, and two aspects of this problem need positive Government support and finance. First, financial aid should be given to industry to create more technical apprenticeships, rather than to schools to keep able young people at school studying subjects not necessarily related to future employment. Secondly, a greater emphasis should be placed on training more undergraduates in the manufacturing processes, and on relating the studies of many more to industry rather than the social services and the arts.

2. Career Security and Satisfaction in the Public/Industrial Sector

The South-West Department of Industry representative made the point that industry must concentrate on giving better job security and satisfaction to compete with the public sector, and must foster initiative and inventiveness from the shop floor upwards. Many industries, however, need to develop more flexible senior managements if this is to be achieved.

3. Qualities needed for Change

A representative of the Armed Services suggested that qualities of leadership must not be overlooked in the development of any new strategy for change.

4. Manpower Planning

Many speeches indicated that although manpower planning is difficult, supply and demand must be better matched. Too frequently supply outstripped demand or vice versa, but better matching could be achieved by more "basic" and "flexible" training programmes being developed, so that redeployment could be more easily effected where supply and demand did not match.

5. Application of Knowledge in Secondary Education

Both industrialists and educationalists stated that too much emphasis was placed on the acquisition of knowledge rather than on its application, and the demands of Higher Education and the 'O' and 'A' level examinations had much to answer for in this respect. However, initial teacher training and in-service programmes needed to lay greater emphasis on methods and courses that fostered design, problem solving, creative and divergent skills. Syllabuses that encourage problem solving skills and schemes that inform teachers about industry should be positively encouraged and strongly supported by the teaching profession and industry.

6. Recruitment to Engineering, Law and Medicine

The clearer idea that young people have about such professional careers as Law and Medicine detracts from the less distinct profile of the Engineer, was raised by more than one speaker. The high rewards of the doctor or barrister and their public esteem, also throw the engineer into poor relief. Government pay policy and the general education many young people receive are doing very little to redress the balance.

7. The Universities

Two senior University Professors stated that many science and engineering courses were too watertight and traditional to accommodate the country's present needs, and too many careers teachers were still advocating a pure science degree was academically more respectable than an engineering degree. Some firm action needed to be taken at a high level to alter this situation.

8. Science and Technology Regional Organisations

The Chairman of the SATROs panel drew the attention of the conference to the network of these organisations, supported by the SCSST and the Department of Industry, which help to foster the interchange of ideas and information between school, industry and higher education. Specific courses developing technological skills were also beginning to appear, such as the Schools Council's Modular Courses in Technology, which will develop some of the qualities lacking in today's young school leavers.

9. The Individual and Society

More attention must be given to helping children not able to develop the necessary skills needed for employment in the future to cope with more "leisure", and the needs of the individual must not be lost sight of compared with the needs of society. On the other hand, if our society is not stable and wealth producing, then the needs of the individual will not be catered for even at the basic level of food, warmth and shelter.

10. The Future and the South-West

The conference gave strong support that the day ought to be viewed as the start of an on-going programme to educate all sections of the community to the problems of the future. With this in mind, the Steering Committee behind the conference were asked to re-convene after the conference to initiate, monitor and support activities in this particular arena, using the services and expertise available through the membership of the conference. The Science and Technology Education Centre of Bath University School of Education was asked to provide the necessary secretariat and servicing support.

CONFERENCE MEMBERSHIP

Opening Remarks and Welcome

Professor P. J. Matthews, Vice-Chancellor, University of Bath

Chairman - Morning Session

Dr. W. H. Darlington, Managing Director, Stothert and Pitt Ltd.

Chairman - Afternoon Session

Professor K. Austwick, Head of Bath University School of Education

Speakers

Professor Tom Stonier, School of Science and Society, University of Bradford

Mr. Kenneth Owen, Technology Correspondent, The Times

Mr. Colin Barnett, Secretary, North-West Regional Council of the TUC

Mr. Kenneth Adams, Comino Fellow, St. George's House, Windsor Castle

Mr. Michael Harrison, Chairman, SCSST, Chief Education Officer, Sheffield

Steering Committee

Dr. R. L. Page (Chairman), Director of Bath University Science and Technology Education Centre

Mr. D. Bloomfield, Executive Secretary, SCSST

Dr. B. Dacre, Rutherford Laboratory, Royal Military College of Science

Professor W. H. Dowdeswell, Bath University School of Education

Mr. A. Garnham, Principal Adviser, Avon Education Department

Canon J. J. Kelly, St. John's Presbytery, Bath

Mr. P. Sellwood, Adviser for Design and Technology, Wiltshire Education Department

Mr. E. Semper, SCSST Representative, School of Science and Society, University of Bradford

Mr. J. G. Reid, Principal, Training Management Service, Engineering Employers' West of England Association

Mr. M. R. Forsey, Managing Director, South Western Industrial Research Ltd., University of Bath

Mr. K. J. Blake, Secretary, Bristol and West of England Engineering Manufacturers' Association Ltd.

Members

Brigadier R. A. King, representing Signal Officer-in-Chief (Army)

Mr. J. T. Poole, Schools Liaison Officer, Avon Science and Technology Centre

Mr. D. Potter, Principal Research Officer, South-West Regional Office, Department of Industry

Mr. R. C. McVickers, Regional Director, South-West Regional Office, Department of Industry

Dr. G. M. Owen, Principal, St. Mary's College, Cheltenham

Mr. L. A. J. Gardiner, Managing Director, Western Works, Bristol

Mr. J. Harlow, District Training Officer, Education Centre, Royal United Hospital

Mr. S. Sykes, Headmaster, Grange School for Boys, Bristol

Mr. R. West, Director, Probe Engineering Co. Ltd., Cirencester

Mr. S. Andrews, Headmaster, Clifton College, Bristol

Mr. D. A. Yardley Wright, Careers Adviser, Wycliffe College, Stonehouse

Mr. J. A. Cole, Head of Department of Management, The College, Swindon

Mr. J. C. Heywood, Group Chief Executive, The Horstmann Gear Co. Ltd., Bath

Mr. C. Graham Kaye, Headmaster, Rodway School, Mangotsfield

Mr. R. A. Atkinson, Head of Chemistry Department, Taunton School

Mr. G. C. Hill, Senior Science Master, Bristol Grammar School

Mr. F. J. Davies, Head of Science, King's School, Bruton

Mr. B. R. Couzens, Head of Careers, King's School, Bruton

Canon A. L. Birbeck, Diocesan Laity Training Officer, Wells

Mrs. M. R. Sellers, Headmistress, Hayesfield School, Bath

Miss S. Brown, Deputy Headmistress, Hayesfield School, Bath

Mr. D. M. Turner, Director, New Projects, Avon Rubber Company Ltd.

Mr. G. H. Turner, Managing Director, West County Supplies Ltd., Bath

Mr. J. Lee, Headmaster, Katharine Lady Berkeley's School, Wotton-under-Edge

Mr. E. Vaughan Southam, Director, The Dickinson Robinson Group Ltd., Bristol

Lt. Col. B. D. Hilton, SO1 (Instructional Technology), Army Education

Mr. J. C. Hollinghurst, Industrial Liaison Officer, Bureau of Industrial Liaison, University of Surrey

Mr. T. A. G. Silk, HMI, Department of Education and Science

Rear Admiral J. A. Bell, Director of the Naval Education Service, London

Mr. A. M. Wring, Managing Director, A.M.W. (Engineering) Ltd., Nailsea

Professor G. F. C. Rogers, Head of Department of Mechanical Engineering, University of Bristol

Mr. J. Cutter, Headmaster, Fisherton Manor Middle School, Salisbury

Dr. P. Reason, Research Fellow, Centre for the Study of Organizational Change and Development, School of Management, University of Bath

Mr. D. R. Cleaton, Assistant Principal Careers Officer, Wiltshire Education Department

Mr. P. A. Coggin, Headmaster, Park School, Swindon

Mr. D. Terry, Headmaster, The Headlands School, Swindon

Dr. P. Biggs, Science Adviser, Wiltshire Education Department

Mr. P. F. Quantick, Co-ordinator, Education and Industry, Castledown School, Ludgershall

Mr. W. G. Morgan, Headmaster, Sheldon School, Chippenham

Mr. G. Starr, Company Training Officer, Stothert and Pitt Ltd.

Mr. C. R. H. Buckley, Deputy Headmaster, West Hatch High School, Loughton

Prebendary R. Lankester, Bath University Chaplain

Rev. Roger Nunn, Baptist Chaplain, University of Bath

Canon J. P. Leahy, Holyrood, Swindon

Dr. M. A. Coles, Lecturer in Chemistry, Department of Science and Mathematics, Brunel Technical College, Bristol

Mr. A. E. J. Bond, Department of Industry, London

Mr. D. J. Higham, Head of Science, Hartcliffe School, Bristol

Mr. J. B. Hughes, Lecturer, Edgehill College of Education, Ormskirk

Mr. T. Floyd, Leverhulme Project Director, ARC Project, School of Engineering, University of Bath

Mr. P. J. McMahon, Director of Studies, School of Engineering, University of Bath

Brigadier D. V. Henchley, SCSST, Keble College, Oxford

Professor R. E. Thomas, School of Management, University of Bath

Mr. N. D. Stears, County Science Adviser, Gloucestershire Education Department

Wing Commander D. E. Priestley, Senior Staff Officer, RAF Training (Education)

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Mr. B. J. Gunnell, Head of Science, Highwood School, Nailsworth

Dr. B. Bolton, Lecturer, School of Electrical Engineering, University of Bath

Mr. M. Gibson, Senior Master, Ralph Allen School, Bath

Miss M. E. Tasker, Lecturer, School of Education, University of Bath

Mr. D. W. Jones, Company Training Officer, Westinghouse Brake and Signal Company, Chippenham

Mr. T. H. Turner, Technical Training Officer, Westinghouse Brake and Signal Company, Chippenham

Dr. H. E. Stutchbury, County Planning Officer, County of Avon

Mr. G. J. Whitty, Lecturer, School of Education, University of Bath

Mr. J. L. Harris, Development Manager, Mardon Flexible Packaging Ltd., Midsomer Norton

Mr. C. I. Jones, Marketing Services Manager, Mardon Flexible Packaging Ltd., Midsomer Norton

Mr. C. R. Streat, Marketing and Development Director, Mardon Flexible Packaging Ltd., Midsomer Norton

Mr. D. M. Mann, Regional Training Officer, Engineering Industry Training Board

Dr. A. G. Owen, Staff Tutor, Open University

Dr. R. England, Lecturer, School of Chemical Engineering, University of Bath

Mr. P. E. Coleman, Field Officer, Schools Council

Professor J. M. Ziman, FRS, Director, HH Wills Physics Laboratory, University of Bristol

Mr. J. P. MacLaren, Secretary for Regional Affairs, Council of Engineering Institutions

Mr. W. Hammond, Head of Careers, Culverhay School, Bath

Mr. P. E. G. Isaac, Headmaster, Patchway High School, Bristol

Mr. R. Price, Assistant Training Manager, R. A. Lister and Co. Ltd., Dursley

Mr. D. A. Gale, Group Training Manager, R. A. Lister and Co. Ltd., Dursley

Lt. Col. J. S. Symons, Colonel Recruiting, Royal Engineers

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Mr. K. W. Browning, Group Personnel Director, Dowty Group Ltd., Cheltenham

Mr. F. Hodgson, Chief Adviser, Wiltshire Education Department

Mr. J. MacDonald, Apprentice Training Manager (Staff), Rolls Royce Ltd., Aero Division, Filton

Rev. Graham Potter, Social and Industrial Team, Diocese of Bristol

Mr. M. H. L. Lewis, Deputy Chairman and Managing Director, R. A. Lister Ltd., Dursley

Mr. R. Brown, Frome Careers Officer

Mr. G. Catchpole, Senior Lecturer, Bath Technical College

Mr. J. D. Oliver, Project Leader, Avon Social Services Department

Mr. A. Hathway, Senior Lecturer, Department of Town and Country Planning, Bristol Polytechnic